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A PRELIMINARY GUIDE FOR RANGE RESEEDING
IN ARIZONA AND NEW MEXICO



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Reseeding restores forage on depleted ranges



Southwestern Forest and Range Experiment Station
Tucson, Arizona
Raymond Price, Director

SUCCESSFUL RESEEDING DEPENDS UPON
THESE PRINCIPLES

1. Selecting good areas for reseeding
2. Preparing the site for planting
3. Planting suitable species
4. Using good seed
5. Observing proper rate and depth for planting
6. Planting at the proper season
7. Maintaining reseeded stands by good management

Cover Photo: Deteriorated mountain parks can be restored to their former high productive capacity by reseeding. The range to the right of the fence produces less than 50 pounds of low value herbage, whereas the reseeded range on the left yields more than 750 pounds of smooth brome per acre.

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A PRELIMINARY GUIDE FOR RANGE RESEEDING

IN ARIZONA AND NEW MEXICO^{1/}

by

H. G. Reynolds, F. Lavin, and H. W. Springfield
Range Conservationists, Southwestern Forest and Range
Experiment Station, Tucson, Arizona^{2/}

WHY RESEED

Range reseeding, properly done, can aid in restoring forage on many range lands. It is the purpose of this publication, based on experience and research to date, to explain briefly the why, when, where, and how of reseeding for several different kinds of range lands in Arizona and New Mexico.

Among the worthwhile reasons for reseeding are:

1. To increase forage by restoring perennial grasses on ranges where they are now absent, or so scarce that there is little chance of natural recovery through better range management alone. Manyfold increases in forage are possible by successful reseeding. Depleted sagebrush lands in northern New Mexico have been increased tenfold in forage productivity. Near Williams in northern Arizona, herbage production in depleted pine parks has been increased in two years from 160 to 560 pounds per acre.
2. To correct seasonal deficiencies in range forage. By selecting plant species which produce green forage earlier in the spring and continue growth later in the season than remnant native grasses, the nutritional level of the range can be maintained over a longer period of time. For example, on many woodland ranges in Arizona and New Mexico blue grama, which is green for only a short period during the summer, provides most of the forage. By planting crested wheatgrass, the availability of green succulent forage is increased from one to two months in the spring and by an equal period in the fall.
3. To provide special use areas needed in a sound ranch management plan. Among such areas are special lambing and calving grounds, "hospital" or holding pastures, and certain other short-time heavily used areas.

^{1/} This material is based on continuing research by the Southwestern Forest and Range Experiment Station, Tucson, Arizona, as well as numerous observations of plantings by the Forest Service, Soil Conservation Service, and private ranchers in Arizona and New Mexico.

^{2/} Maintained by the Forest Service, U. S. Department of Agriculture, for Arizona, New Mexico, and West Texas, with headquarters at Tucson, Arizona.

4. To prevent erosion where there is danger of soil loss. Reseeded grasses can protect the soil on dikes, earthen dams, stream banks, and areas denuded of vegetation by fire or by the construction of roads, trails, and pipe lines.

WHERE WILL RESEEDING BE EFFECTIVE

Research to date indicates that certain sites in several broad zones of natural vegetation in Arizona and New Mexico can be reseeded successfully. Recognition of zones is helpful in selecting sites, methods, and species for reseeding inasmuch as reseeding problems throughout any one major zone generally are similar. Dominant vegetation is most useful in identifying these zones. Those sites for which reseeding practices have been sufficiently developed through research and experience to make recommendations possible occur in the zones identified by: (1) ponderosa pine, (2) big sagebrush, (3) woodland, and (4) semidesert grassland. Research knowledge does not yet permit reseeding recommendations at the present time for other sites in these zones or for other zones.

Reseeding sites in the ponderosa pine.--Ponderosa pine (Pinus ponderosa) makes up the principal plant formation at elevations from 6000 to 9000 feet on the higher mountains and plateaus throughout Arizona and New Mexico. Average annual precipitation varies from 20 to 30 inches. Occurring throughout these forests are many natural parks or openings varying from 10 to 100 acres in size, which in some cases are favorable reseeding sites. Where ranges are in good condition natural parks and the understory of the more open forests are occupied by many perennial forage plants such as Arizona fescue (Festuca arizonica), mountain muhly (Muhlenbergia montana), muttongrass (Poa fendleriana), and blue grama (Bouteloua gracilis). Herbage production commonly amounts to as much as 1000 pounds per acre and provides enough forage to support a cow for a month.

On many natural parks the original herbaceous cover of perennial forage plants has been disturbed. Some openings were once farmed and have now been abandoned, with the land producing little if any perennial vegetation. Perennial grasses on other forest parks have been depleted by continued improper grazing. Some of these areas have a fair cover of low value blue grama with scattered plants of more valuable perennial grasses but total herbage production is less than 200 pounds per acre. The vegetation on other parks has been reduced to a few scattered clumps of blue grama, with short-lived weeds occupying the otherwise bare spaces between clumps. On some sites perennial grass vegetation is completely absent. Under any one of these stages of perennial grass depletion, rabbitbrush, pingue, or other half-shrubs may have invaded. Where any of these conditions of forage depletion exist, artificial reseeding as recommended herein can be employed to restore the areas to high forage production (Figs. 1 and 2).

Other areas, actually within the timber, can also be benefited by reseeding. When forests are logged, the development of spur roads,

Reseeding Depleted Open Parks and Meadows
Within Pine Forests



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Fig. 1.—Reseeding can greatly increase forage production of deteriorated dry meadows in pine forests. Useless shrubs and other competing vegetation can be removed in large park openings by using a wheatland plow. Seed can best be planted by a single disc grain drill, but broadcasting followed by a spike tooth harrow will also give good results. This park produces only 185 pounds of blue grama per acre and rabbitbrush and pingue are rapidly taking over the site.



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Fig. 2.—The depleted park shown in Fig. 1 after reseeding to big bluegrass. Herbage production was increased to more than one ton per acre.

skid trails and log landings destroys considerable understory forage. On the steeper slopes, loss of the protective herbaceous cover may result in serious soil erosion. Both control of erosion and restoration of forage can be accomplished on denuded areas by range reseeding. When forested areas are severely burned serious soil loss may result, especially on the steeper slopes where there is little understory of herbaceous vegetation. Although the ultimate aim on such areas should be to restore the timber, a protective cover which will quickly stabilize the soil is often essential. Young trees grow too slowly to provide the rapid development of a protective cover that is needed. A herbaceous cover which will preserve the soil for future timber production can be provided by range reseeding.

A wide choice of species for reseeding is possible in the pine zone. Slender wheatgrass (Agropyron trachycaulum), crested wheatgrass A. cristatum, intermediate wheatgrass (A. intermedium), and big bluestem (Poa ampla), will grow throughout the zone, but above 25 inches annual precipitation, orchardgrass (Dactylis glomerata), smooth brome (Bromus inermis), and tall oatgrass (Arrhenatherum elatius), also are adapted and will produce a more palatable and nutritious forage.

Reseeding sites in big sagebrush.--Sagebrush (Artemesia tridentata), is the dominant vegetation in the region north of the Colorado river in Arizona and in north-central New Mexico. Here elevations range from 3000 to 7000 feet and annual rainfall varies from 8 to 19 inches.

Growing conditions vary widely on range lands characterized by sagebrush. On ranges in good condition, sagebrush is not too dense, and Indian ricegrass (Oryzopsis hymenoides), western wheatgrass (Agropyron smithii), and blue grama are usually present and furnish considerable forage. Where these perennial grasses have disappeared, sagebrush has increased or is increasing to the point where grass forage no longer exists.

Certain depleted sagebrush ranges can be greatly improved by reseeding (Figs. 3 and 4). The best reseeding sites are indicated by a dense, vigorous stand of sagebrush (1500 or more mature plants per acre), and a sparse understory of perennial grasses, growing on deep valley bottom soils.

Where bluestem wheatgrass makes up more than 15 percent of the total ground cover and more than half of the perennial grass understory, reseeding may not be necessary to affect forage restoration. Such areas respond markedly when sagebrush is killed and the bluestem wheatgrass thus given an opportunity to grow and produce.

Selection of species to reseed in this zone should be governed by actual annual precipitation and remnant understory vegetation--not by the presence of sagebrush alone. Crested wheatgrass and bluestem wheatgrass can be planted where the annual rainfall is above 15 inches. Surrounding vegetation on these sites will be pine or pinyon-juniper. Remnants of bluestem wheatgrass will usually be present in the understory.

Reseeding Sagebrush Lands



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Fig. 3.—Areas dominated by big sagebrush have a high reseeding potential. Best sites are indicated by pinyon-juniper, or pine immediately adjacent, and scattered plants of bluestem wheatgrass in the understory vegetation. Such areas can be reseeded by removing sagebrush with a disc plow or heavy wheatland plow, and planting crested wheatgrass with a single disc grain drill.



S-11

Fig. 4.—This former sagebrush area which was producing but 60 pounds per acre of perennial grass herbage before reseeding, produced 600 pounds of crested wheatgrass per acre one year after seeding.

Although sites are not so favorable for reseeding when annual rainfall is below 15 inches, successes have been obtained by seeding to sand dropseed (Sporobolus cryptandrus) and chamiza (Atriplex canescens). Sand dropseed and Indian ricegrass may be present as occasional remnant plants on such sites.

Reseeding sites in the woodland.--The dominant vegetation making up the woodland are pinyon (Pinus edulis), and juniper (Juniperus spp.). Annual rainfall varies from 10 to 18 inches through elevations from 4500 to 7000 feet. Open savannahs varying from several acres to a thousand or more acres in extent, are interspersed throughout woodland forests. These openings, when in good condition, support such productive forage plants as bluestem wheatgrass, blue grama, sidecats grama (Bouteloua curtipendula), hairy grama (B. hirsuta), gallita (Hilaria jamesi), and Indian ricegrass.

On many areas the good forage species which are less resistant to grazing have disappeared until blue grama, which is of limited value, is the only forage plant remaining. This change has often been accompanied by an increase in such low value shrubs as rabbitbrush (Chrysothamnus spp.), pingue (Actinea spp.) and snakeweed (Gutierrezia spp.). Juniper is also moving into some savannah openings and is contributing to further reduction in the forage cover and permitting accelerated erosion. Where heavy juniper invasion has occurred, these trees must be eradicated to make successful reseeding possible.^{3/}

Larger openings in these woodland forests, which have deteriorated to the conditions described above, have excellent reseeding possibilities (Figs. 5 and 6). Openings selected for reseeding should be of fairly level topography and perennial grass cover should be limited almost entirely to blue grama producing less than 150 pounds of herbage per acre, thus providing a good opportunity for improvement.

Nutritional balance of range forage also can be improved by reseeding within the woodland zone. During the winter season when these ranges are much in demand, the protein level of native forage is low. By reseeding to a species such as crested wheatgrass, which grows during the cool fall and spring season, the period of green nutritious forage is extended.

The woodland areas include a wide variety of growing conditions and reseeding species and methods must be selected accordingly. The most favorable sites receive more than 15 inches annual rainfall and crested and bluestem wheatgrass can be planted with assurance of success. Below 15 inches annual rainfall, satisfactory reseeding results can usually be obtained only with the aid of contour furrowing, soil pitting, scattering brush, or other methods to conserve and retain moisture. In these lower rainfall areas, reseeding species should be confined to the use of sand dropseed and chamiza.

^{3/} Information obtained to date regarding eradication of Juniper can be obtained from the Director, Southwestern Forest and Range Experiment Station, P. O. Box 951, Tucson, Arizona.

Reseeding Woodland Ranges



K-955B

Fig. 5.—Large openings in the pinyon-juniper woodland such as this one offer good opportunities for increasing grazing capacity by reseeding. Average annual rainfall at this site is 17 inches. Vegetation is mainly pingue, golden aster, fringed sage, and rabbitbrush. Blue grama and squirreltail are producing only enough forage to support one cow on 30 acres each month. Such ranges can be reseeded by destroying the native cover with a wheatland plow, and seeding to crested or bluestem wheatgrass with a single disc grain drill.



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Fig. 6.—By reseeding this site shown in Fig. 5 to crested wheatgrass, grazing capacity was raised to 2 acres per cow month.

Reseeding sites in the semidesert grassland.--This vegetation zone occupies large areas of southern Arizona, and southern New Mexico. Elevations vary from 3000 to 5000 feet, and annual rainfall ranges from 8 to as much as 20 inches. Vegetation is generally sparse even at best, which is a reflection of low rainfall and high evaporation.

Several different vegetative aspects can be recognized according to the dominant plants present. On some ranges black grama (Bouteloua eriopoda), is the main forage species; on others a mixture of grama grasses such as blue, black, hairy (B. hirsuta), slender (B. filiformis), and Rothrock grama (B. rothrocki), are characteristic. Certain ranges are characterized by mesquite (Prosopis juliflora), and other shrubs.

In some of these semidesert grassland areas, where mesquite, cactus (Opuntia spp.), and burroweed (Happlopappus tenuiseptus), either separately or together have greatly increased, perennial grasses have decreased and in some cases disappeared. On some ranges not complicated by shrub invasion, perennial grasses have been completely replaced by annual grasses and weeds. Such vegetation has only a short period of use and ranges are greatly reduced in productivity.

Although restoration of perennial grasses by reseeding on semi-desert ranges is possible, certain precautions in the selection of sites should be observed. Reseeding is recommended at the present time only where average annual rainfall is above 12 inches. If mesquite is denser than 10 or 15 trees per acre, it should be controlled prior to reseeding. Where cactus is present, equipment used in reseeding should be carefully handled to prevent scattering the joints and thus spreading and propagating the cactus. On areas heavily invaded by burroweed, it is best to mow these plants after reseeding, although successful stands of grass have been produced without controlling this half-shrub.^{4/}

ESSENTIAL STEPS FOR SUCCESSFUL RESEEDING

Certain essential steps must always be observed in order to establish a successful stand of grass by reseeding. These are (1) select good sites, (2) prepare the ground for planting, (3) plant suitable species, (4) use good seed, (5) observe proper rate and depth for planting, and (6) plant at the proper season.

Select Good Sites

In addition to the selection of reseeding sites as presented in the foregoing discussion, the best sites in each location should receive the first treatment. Level land with fertile, relatively deep soil is to be preferred. There is less run-off and more rainfall absorption on such areas. Moreover, these lower lands often receive additional moisture as a result of run-off from the adjacent higher slopes. This added soil moisture insures better seedling establishment and growth of mature plants. Danger of losing the planting through soil washing is also decreased.

^{4/} Information on control of mesquite and burroweed can be obtained from the Director, Southwestern Forest and Range Experiment Station, P. O. Box 951, Tucson, Arizona.

Before attempting reseeding, consideration should always be given to the possibility of effecting range restoration by better range management. Deteriorated range areas which are properly used yet show little or no vegetative response under correct management can be profitably reseeded.

Prepare the Ground for Planting

Some method of preparatory treatment is essential for successful reseeding on most ranges. Competing vegetation, such as undesirable weeds and shrubby plants, must be removed. Removal of competing vegetation by plowing also loosens the soil and may result in increased moisture penetration, retention, and better aeration. The most practical and efficient preparatory treatments for planting specific situations characterized by different native vegetation are outlined in table 1.

Special structures or moisture retention devices which prevent run-off, and thus improve site conditions, increase the chance for successful reseeding. These include terracing, scattering brush, constructing check dams, or contour furrows, and basining or pitting the soil. Such measures are especially important in the woodland areas below 15 inches rainfall, and in the semidesert grassland region.

Plant Suitable Species

Differences in elevation, precipitation, and temperature give rise to many variations in growing conditions and species must be selected for each situation. In Arizona and New Mexico annual precipitation varies from 3 inches to more than 35 inches per year. Length of growing season may be as short as 90 days in the higher mountains, to well over 200 days in the southern, lower part of the region.

Only when growth requirements of various grass species are matched with growing conditions can a successful planting be realized. Table 2 lists the species which will produce most desirable results according to the precipitation differences associated with ponderosa pine, sagebrush, woodland, and semidesert grassland ranges.

Use Good Seed

Good quality seed is essential for successful reseeding. Seed should be unshriveled, bright in color, and clean in appearance. Dirty, musty, discolored and shriveled seed should be avoided because these signs are associated with disease, age, and unfavorable harvest and storage conditions. It is best to purchase seed from reliable companies which provide seed of high germination and purity. Percentages which should be expected from the seed of various species are given in table 2. When germination and purity tests are not provided or old seed is used this information can be obtained at little cost by sending small lots of seed to the State Seed Laboratories for testing. Seed older than 4 years should not be used.

Table 1. Recommended methods for preparatory treatment and planting for reseeding different range situations in Arizona and New Mexico

Identifying Vegetation	Specific Situation	Preparatory Treatment	Planting Method
Ponderosa Pine	Open parks and meadows	Wheatland plow (moldboard or disc plow for small areas)	Single disc grain drill.
	Burned over areas	None	Broadcast directly into heavy ash before first rain.
	Logged over areas such as spur roads, landings, and skid trails.	None	Single disc grain drill on level areas; broadcast with light covering of slash on gentle slopes, and heavy covering of slash on steep, rough areas. Seed should be covered with disc harrow, or self-clearing pipe harrow prior to placing slash.
	Favorable sites which are free of rocks and compara- tively level	Brushland plow, heavy disc plow or wheatland plow.	Single disc grain drill when seedbed is free of debris. On heavily littered areas, broadcast ahead when plowing as shallow as 2 to 3 inches; otherwise, broadcast behind plow and cover with disc or pipe harrow, brush, or rail drag.
Big sage- brush	More than 15 inches: Wheatland plow. annual rainfall: large open parks in- vaded by small half- shrubs.	Brushland plow, heavy disc plow or wheatland plow.	Single disc grain drill on rough seed- beds; when seedbeds are smooth and well prepared seed may be broadcast and covered with disc harrow.
Pinyon Juniper Woodland			
Semidesert Grass- land	Open areas with no mesquite invasion/ ¹ at 3-7 foot intervals; or use eccentric discs.	Contour furrow with lister: Use cultipacker seeder, lister planter, or broadcast in furrows and cover with a drag.	

¹/ If mesquite is present it must be controlled prior to reseeding.

Table 2.—Recommended species, seeding rate, depth of planting, and specifications for seed for different situations in Arizona and New Mexico.

Identifying Vegetation:	Annual Rainfall:	Common Name	Species Botanical Name	Seeding rate lbs./ per acre ¹	Depth of planting ²	Average seed specifi- cation in percent	Purity ³	Germination
Ponderosa Pine	Above 25 inches	Orchardgrass	<i>Dactylis glomerata</i>	5-8	1/2	85	85	85
	Smooth brome	<i>Bromus inermis</i>		8-12	1	90	85	85
	Tall oatgrass	<i>Arrhenatherum elatius</i>		7-10	1	85	80	80
20-30 inches	Slender wheat- grass	<i>Agropyron trachycaulum</i>		8-12	1	95	85	85
	Big bluegrass	<i>Poa ampla</i>		5-8	1/2	80	50	50
	Crested wheat- grass	<i>Agropyron cristatum</i>		5-8	1/2	95	85	85
	Intermediate	<i>Agropyron intermedium</i>		6-9	1	90	90	90
	wheatgrass							
Sagebrush and Woodland	Above 15 inches	Crested wheat- grass	<i>Agropyron cristatum</i>	5-8	1	95	85	85
		Bluestem wheat- grass	<i>Agropyron smithii</i>	8-12	1	80	80	80
		Chamiza	<i>Atriplex canescens</i>	10-15	1/2	—	—	—
		Sand dropseed	<i>Sporobolus cryptandrus</i>	2-4	1/2	90	80	80
Semidesert Grassland	Above 12 inches	Lehmann love- grass	<i>Eragrostis lehmanniana</i>	1-2	1/2	85	65	65
		Boer lovegrass	<i>Eragrostis chloromelas</i>	1-2	1/2	95	70	70
		Chamiza	<i>Atriplex canescens</i>	10-12	1/2	—	—	—

1/ Seeding rate when species are seeded alone; use higher rate when broadcasting, lower rate when planting with drill, lister, or cultipacker. Plant 6-inch rows above 20 inches annual precipitation, 12-inch rows below that amount of moisture.

Observe Proper Rate and Depth for Planting

Successful reseeding depends upon planting seed at the proper rate and depth (see table 2). Enough seed should be sown to provide sufficient plants to fully occupy the area. If too little seed is planted a long waiting period will be necessary before the stand reaches full density through natural reproduction. Overseeding should also be avoided, since it produces numerous small spindly plants which compete severely with each other.

Covering the seed protects it against harmful moisture and temperature fluctuations but if it is planted too deeply the seedling is unable to force its way up through the thick layer of soil. The seed should, therefore, be planted as deeply as possible consistent with satisfactory emergence. Proper depth varies with the size of seed.

Various types of farming equipment can be used for seed coverage. Seed can be distributed and covered in one operation with the single disc grain drill, the lister planter, or the cultipacker seeder. Broadcasting is less effective than any of these methods, but more practical under certain situations. On burned-over, logged, or stony or debris littered areas, broadcasting must be used. Except where seeding into a deep ash on burned-over areas, some provision should always be made for covering the seed after it is broadcast.

Plant at the Proper Season

Under arid and semiarid conditions the soil surface dries rapidly and seedling establishment is precarious. Plantings made shortly before or at the time of optimum moisture and favorable temperature conditions have the greatest chance for success. Over most of Arizona and New Mexico, July and August are the months having the best distribution of rainfall, in greatest amounts. Reseedings made in June or early July have been most consistently successful. At higher elevations, where snow blankets young grass seedlings during the winter, it is also possible to plant early in September.

EQUIPMENT FOR RANGE RESEEDING

Various kinds of equipment have been found suitable for removing competing vegetation, and providing for proper and efficient distribution and coverage of seed.

Removing Competing Vegetation

The most efficient type of machinery for removing competing vegetation varies with the nature of the vegetation, necessity for moisture conservation, size of the area to be reseeded, and other factors. Some of the most useful equipment is described below:

Disc plows.--These plows, with discs mounted as individual units, have their greatest usefulness where the soil is heavy clay, or is stony,

or the site is occupied by a heavy stand of big sagebrush. The plows are not as economical to operate as the wheatland plow, but do a more satisfactory job of sagebrush eradication; and are subject to less breakage where there are many stones or stumps present.

Wheatland plows.--Most wheatland plows cut a wider swath but do not cut as deeply as the standard disc plow. All discs are mounted on a common shaft. The wheatland plow is most efficient for removing competing vegetation and preparing a seedbed in pine openings, sagebrush lands, and large openings in the pinyon-juniper woodland (fig. 7). Discs should be 20 to 24 inches in diameter for most work, but 26 inches or more for eradicating sagebrush. The plow should be set at an angle of 40 to 45 degrees with the direction of pull; and should be weighted so as to cut consistently at 2 to 4 inches depth.

Brushland plow.--This is new reseeding equipment recently developed by the U. S. Forest Service and now being widely tested. It combines the desirable features of disc plowing with a minimum of breakage. Discs are mounted in pairs and held in the ground by spring tension (fig. 8). Paired discs can thus rise over a rock or similar obstruction while the other discs continue to cut. This equipment is primarily adapted to the removal of sagebrush, and preparatory treatment of land too rough and rocky for standard farm implements.

Moldboard plows.--This type of plow, used most commonly in farming activity, is most useful for preparing contour furrows in drier parts of the woodland, and semidesert grassland.

Lister.--This equipment consists of a heavy frame to which a wide middlebuster (a double moldboard) is attached. A broad furrow, 3 to 6 inches in depth, is opened. The equipment is most useful where contour furrowing is desired in arid sections of the woodland and the semidesert grassland where moisture conservation and retention are essential.

Eccentric disc.--An ordinary wheatland plow may be modified into an eccentric disc by removing every other disc and alternately offsetting the remaining discs some 2 inches above and 2 inches below the main axle. This equipment makes a series of staggered pits approximately 24 inches long, 8 inches wide, and 4 inches deep. It is proving to be most useful on semidesert grassland ranges where perennial grasses are no longer present and mesquite invasion has not occurred.

Cutaway disc.--This equipment accomplishes the same purpose and can be made from the same base as the eccentric disc (fig. 9). Instead of offsetting, a portion of every other disc is cut off, so as to produce a pitting pattern when the equipment is operated.

Covering the Seed

Single disc grain drill.--This farm equipment is highly efficient for distributing and covering seed. It should be used whenever possible.

Reseeding Equipment



Fig. 7.—The Wheatland plow being used here to eliminate sagebrush is also satisfactory for preparatory treatment of deteriorated pine openings and open savannahs in the woodland. By attaching a drill behind the plow, planting and sagebrush eradication can be accomplished in one operation, provided the operation is confined to recommended planting season.



Fig. 8.—The brushland plow is specially constructed for preparatory treatment prior to seeding. It eliminates all competing vegetation, and can be employed on lands too rough and rocky for ordinary farming equipment.

Lister planter.-- Planter attachments can be obtained for the regular lister, so that contour furrowing and planting can be accomplished in one operation.

Cultipacker and cultipacker seeder.--A cultipacker consists of a series of solid wheels, usually 12 inches to 18 inches in diameter and 4 inches wide, mounted on a single axle. Units may be in single or tandem arrangement. The equipment was designed to pulverize and pack soil, but has also proved practical for covering small seeds after broadcasting by hand or with mechanized equipment.

A cultipacker seeder can be constructed by arranging tandem cultipackers so that the wheels track each other and attaching seed hoppers (fig. 10). Four seed hoppers are usually mounted on an 8-foot unit and the spout feeds arranged so as to give seed distribution at 1-foot intervals. The cultipacker seeder is most useful for planting small-seeded species such as the lovegrasses and sand dropseed.

Hand broadcasters.--"Whirlwind" or "Cyclone" seeders throw out a swath of seed from a hand-operated whirling disc. With a little experience a man can adjust his pacing or rate of travel to the required number of hand revolutions of the disc and thereby obtain a uniform and desired rate of seeding.

Mechanized broadcasters.--These units may be mounted on tractor, caterpillar, plow, truck or wagon. In all cases they must be synchronized with rate of progression. When seeding ahead of the plow, it is most practical to have the motorized broadcaster on the tractor. When seeding behind the plow, some provision must be made for covering the seed.

Disc harrow.--These harrows will do a good job of covering seed on hard, rocky, or debris covered soils where a drill cannot be employed. The equipment usually consists of 10- to 15-inch discs spaced 8 to 12 inches apart either in single or tandem arrangement.

Self-clearing pipe harrows.--This equipment is a series of pipes which have been fitted with spirally arranged spikes. The pipes are pulled end first, and are free to rotate behind a common draw bar. Such a harrow can be constructed by using 4 to 6 pieces of 3- or 4-inch pipe attached on swivels behind a railroad rail. Tool steel spikes can be welded at right angles to the pipes. The equipment is most useful for covering seed along logging roads, skid trails, and other rocky, rough or heavily littered areas.

Rail drag.--A piece of railroad rail behind which are fastened several small trees or pieces of heavy brush will often serve in place of more elaborate equipment when the seedbed is loose and rough, and there is considerable opportunity for sloughing off the higher ridges. Such equipment has resulted in satisfactory coverage of seed in sagebrush areas where eradication was originally accomplished with a wheatland plow.

Reseeding Equipment



Fig. 9.—The Krause No. 9 cutaway disc can be successfully handled by a Fordson or jeep for preparatory treatment of the land under semidesert grassland condition. The equipment leaves a pattern of staggered pits which catch additional rainfall and assists in obtaining better moisture infiltration on areas to be reseeded.

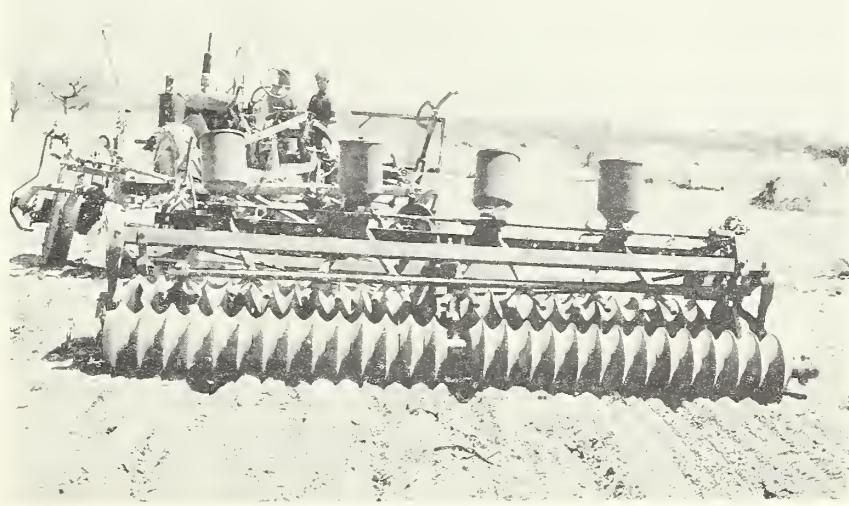


Fig. 10.—The Tandem cultipacker seeder is useful for planting small seeded species such as lovegrass and dropseed. Planet Junior hoppers supply seed rate control and seed is pressed into the ground by the cultipacker wheels.

GOOD GRAZING MANAGEMENT MAINTAINS RESEEDED RANGES

Grazing of reseeded ranges should be deferred until seed is produced by the newly established plants. This usually necessitates keeping livestock off reseeded areas for at least two growing seasons by fencing, herding, or deferment. Light grazing which results in some trampling by livestock at this time may prove beneficial by covering new seed with soil. Fences constructed to protect newly seeded areas can be planned to provide proper season of use, uniform distribution, and other good management features in later years. Allowing plants to mature gives them an opportunity to develop a strong deeply penetrating, widely branching root system, and vigorous top growth. Plants are then better able to cope with drought, cold, disease, and removal of top growth as a result of grazing.

Proper grazing practices should be followed on reseeded ranges or they will revert to a deteriorated condition. Reseeding is an integral part of good range management--not a substitute for it. Reseeded ranges should be grazed at the proper time, stocked conservatively, and livestock should be evenly distributed by practices such as fencing, water development, salting or riding.

Time for grazing will vary with the location of the range unit and the reseeded species. Before livestock are admitted to reseeded areas during the spring, new leafage should be well developed, plants should be growing vigorously, and the soil dry enough to permit grazing without becoming compacted or cut up by the hoofs of animals.

Reseeded ranges should be stocked lightly enough so that there is enough herbage left at the end of the grazing season to maintain the plants. Provision should be made for removing livestock to some other unit when the range is properly utilized. Ranges reseeded to crested wheatgrass commonly provide more than 500 pounds of forage per acre and can be safely stocked at a rate of 2 acres per cow month (fig. 6). Fifty to sixty percent utilization of this species by weight or volume does not damage the plants. Moreover, some reserve of herbage is left to return litter to the soil and to aid in building up the range. Reseeded stands, when properly managed, can be a continuing asset. Five- to ten-fold increases in grazing capacity realized by reseeding can be maintained by proper management and use and will furnish abundant forage for many years.

RANGE RESEEDING CAN:

1. Restore forage on depleted ranges.
2. Correct deficiencies in forage on certain seasonal ranges.
3. Provide forage for special use on lambing and calving grounds, and on "hospital" pastures.
4. Stabilize soil where the protective plant cover has been destroyed by fire, mechanized disturbance, or other improper use.
